Procedures and Guidelines

DIRECTIVE NO. 415-PG-7120.1.1
EFFECTIVE DATE: April 7, 1999
EXPIRATION DATE: N/A

APPROVED BY Signature: **Original signed by:**
NAME: **Martin A. Davis**
TITLE: **GOES Program Manager**

Responsible Office: 415/GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE (GOES) PROGRAM

Title: GOES PROGRAM PLAN

1. PURPOSE

This Procedure and Guideline (PG) formalizes the GOES Program Plan as issued in compliance with NPG-7120.5, NASA Procedures and Guidelines. The program plan summarizes the overall purpose of the program and provides generalized knowledge of project and customer roles, management and requirements.

2. REFERENCE

NPG-7120.5, NASA Procedure and Guidelines
GPG-1060.2, Management Review and Reporting for Programs and Projects
GPG-1310.1, Customer Commitments and Review
GPG-7120.1, Program Management
GPG 7120.2, Project Management
GPG-8730.4, Quality System

3. SCOPE

The program plan summarizes the overall purpose of the program and provides generalized knowledge of project and customer roles, management and requirements.

4. DEFINITIONS

Definitions are referenced in the GOES Program Plan.

5. AUTHORITIES AND RESPONSIBILITIES

Authorities and responsibilities are defined in the GOES Program Plan and corresponding Project Plan.

6. IMPLEMENTATION

Implementation is in accordance with the GOES Program Plan.

7. RECORDS

There are no quality records resulting from the processes described herein.

CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes
Baseline	April 7, 1999	Initial release.

Program Plan

Goestationary Operational Environmental Satellites Program (GOES)

April 1999

In the event that a commitment cannot be met, it is the responsibility of the signing parties to notify the other and initiate the timely re-negotiation of the terms of this agreement.

Agreements:

_____ _____

A. V. Diaz — Date
Director
Goddard Space Flight Center

_____ _____

Ghassem Asrar — Date
Associate Administrator of
Earth Science

_____ _____

Martin A. Davis — Date
GOES Program Manager

PROGRAM PLAN
Geostationary Operational Environmental Satellites (GOES) Program

1.0 PROGRAM OVERVIEW

Over the past 35 years, environmental service agencies have stated a need for near continuous, timely, high-quality observations of the Earth and its environment. In response, the GOES Program was established as a reimbursable program responsible for the procurement, development and verification testing of the spacecraft, instruments, related ground support systems, and launch services for the National Oceanic and Atmospheric Administration (NOAA) geostationary weather satellite program. The normal operational system consists of two geostationary satellites stationed at 75 and 135 degrees west longitude that provide continuous full coverage of the U. S. and adjacent oceans. Each satellite provides a suitable platform to support the environmental monitoring instruments that are used to perform measurements of the Earth's atmosphere, its surface, cloud cover, and electromagnetic environment.

The Program is segmented into two fully functional and independent NOAA projects, GOES I-M and GOES N-Q. GOES I-M encompasses the launch of five satellites that meet NOAA requirements. The GOES Program has successfully launched GOES-I (GOES-8), GOES-J (GOES-9), and GOES-K (GOES-10). After post-launch checkout the satellites were handed-over to NOAA for operation. The next two satellites are scheduled for launch the spring of 1999 (GOES-L) and 2002 (GOES-M).

The GOES N-Q satellites are a new series that will provide continuity of services that are presently being provided by GOES I-M. This series of spacecraft includes numerous improvements that will enhance and improve performance.

2.0 PROGRAM OBJECTIVES

The objectives of the GOES Program are to procure, test and launch an operational geostationary satellite system which meet the observational requirements specified by NOAA.

The specific program objectives are as follows:

a) Provide environmental data that will be used to produce and support routine meteorological analysis and forecasts
b) Maintain continuity of services to the user agencies

c) Provide environmental data that will be used to expand knowledge of mesoscale and synoptic scale storm development
d) Provide data that will be used to assist in forecasting severe weather events
e) Contribute to the development and enhancement of a domestic and international in-situ environmental warning service
f) Provide for the reception of early emergency distress signals to aid the Search and Rescue Satellite Aided Tracking (SARSAT) operation
g) Improve the capability of forecasting and real-time warning of solar disturbances
h) Provide data that will be used to expand knowledge and understanding of the atmosphere in order to improve short and long-term weather forecasts

3.0 CUSTOMER DEFINITION AND ADVOCACY

The National Oceanic and Atmospheric Administration (NOAA) is the customer of the GOES Program. The process is defined in the 1998 Memorandum of Agreement (MOA) between NASA and NOAA for the GOES Program. This agreement defines the general principals and guidelines that will govern the collaboration between NOAA and GSFC.

4.0 PROGRAM AUTHORITY AND MANAGEMENT STRUCTURE

The Governing Program Management Council (GPMC) is NASA Headquarters (HQ). NASA HQ has delegated program management responsibilities to the Goddard Space Flight Center (GSFC). Within GSFC, the Flight Projects Directorate has responsibility for the GOES Program. The GSFC organization chart is shown in Figure 4.1. Management responsibilities for the Enterprise Associate Administrators (EAA), Program Manager, and Project Manager are in accordance with NPD 7120.4 and NPG 7120.5.

The GOES Program has full responsibility for the successful implementation of two NOAA projects, GOES I-M and GOES N-Q.

A single Program Manager and two deputies manage both projects. To the extent practicable, the technical and administrative staffs of the two projects are separate and distinct. The organization chart for the GOES Program is included in Figure 4-2.

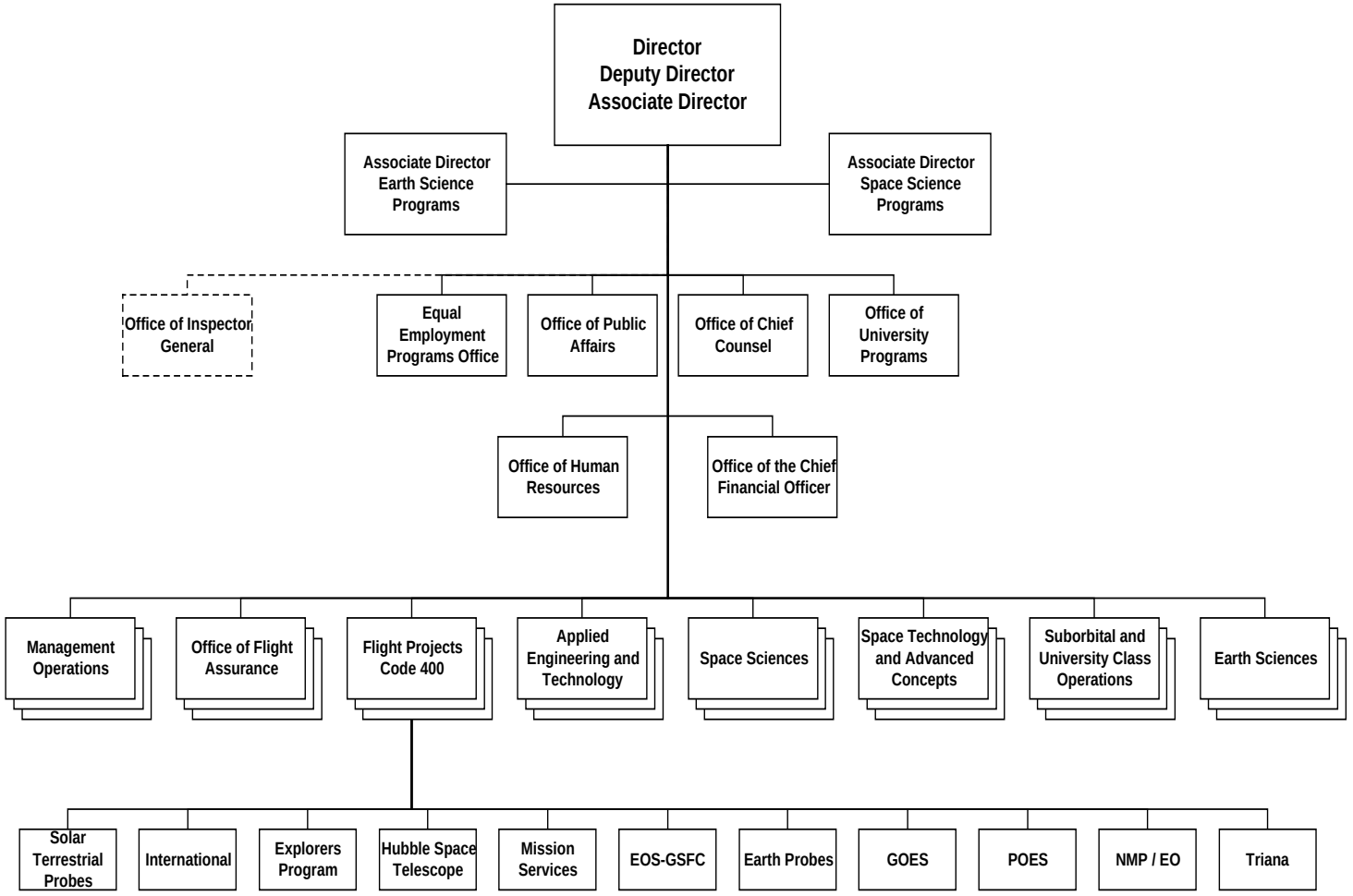

Figure 4-1, GSFC Organization Chart

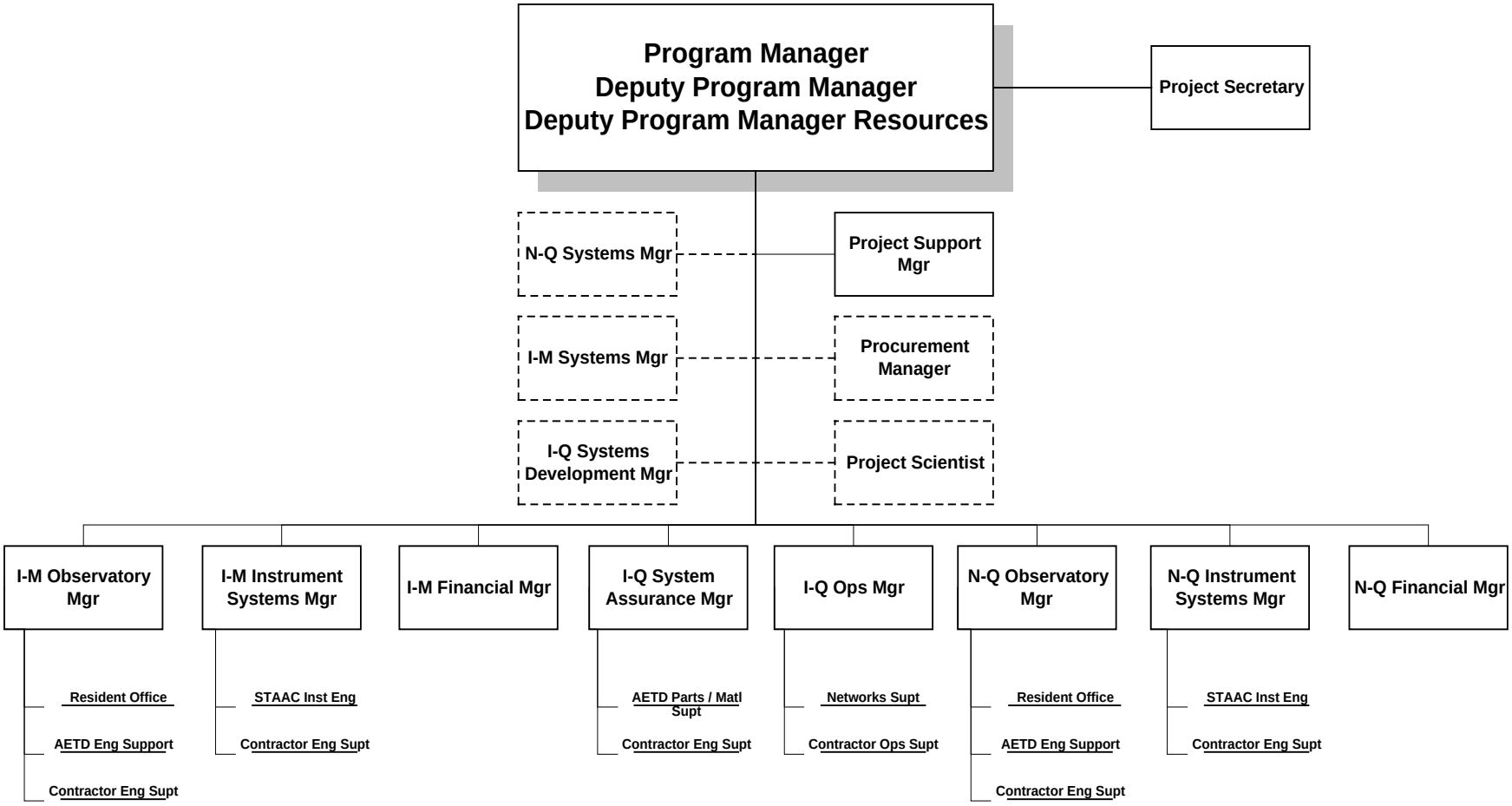

Figure 4-2, GOES Organization Chart

4.1 Program Manager

The Program Manager is responsible for the performance of all necessary functions to ensure the total management of the Program. Specifically, he is responsible for the planning and evaluation; systems tests; reliability and quality assurance; spacecraft compatibility; scheduling; health and safety; budgetary and financial planning; technical monitoring; life-cycle logistics cost; and project reporting. The Program Manager has full authority to carry out these functions, subject to limitations established by the GSFC Director. Additionally, the Program Manager performs a dual role as the Project Manager. In this capacity, he provides assistance and support, either administratively or functionally, to the project management organization.

4.2 Deputy Program Manager

The Deputy Program Manager (DPM) is responsible to the Program Manager and is an integral member of the management team. He supports the Program Manager in directing all phases of the Program and Projects, and has project-wide responsibility for personnel management, planning and evaluation. Additionally, he provides technical support and assistance to the project management organization. In the absence of the Program Manager, the DPM assumes full responsibility for program management.

4.3 Deputy Program Manager/Resources

The Deputy Program Manager/Resources (DPM/R) is responsible to the Program Manager and is an integral member of the management team. He contributes business management expertise to the establishment of technical program objectives and is responsible for the application of business, financial management, and performance measurement techniques. The DPM/R supervises a team of specialists in the areas of finance, budget, performance measurement, scheduling, pricing, and configuration and data management. In the absence of the Program Manager and the DPM, the DPM/R assumes full responsibility for program management.

5.0 PROGRAM REQUIREMENTS

Each series of satellites in the GOES Program are designed for five year missions, however, NOAA determines the actual satellite replacement schedule based upon the performance of the on-orbit spacecraft. The GOES system is designed to acquire and disseminate environmental data from a near-equatorial Earth orbit at geostationary altitude. Major functions of the system are to support the Imager, Sounder, Solar X-ray Imager (SXI), and Space Environmental Monitor (SEM) instruments. Other functions of the system are to: support a collection of terrestrial and oceanographic Data Collection Platforms (DCP); Relay Weather Facsimile (WEFAX) and imaging and sounding data between Earth terminals; relay the Emergency Manager's Weather Information (EMWIN) broadcast; and provide rapid detection of distress signals from Emergency Locator Transmitters (ELT).

The GOES I-M system utilizes a three-axis body stabilized spacecraft that provides near-continuous monitoring of the Earth's atmosphere by imaging and sounding radiometers located on the spacecraft. The spacecraft consists of a central body containing all the propulsion and electronic components and provides a platform for payload instruments. The payload instruments on the spacecraft consist of the Imaging and Sounding instruments, X-ray Sensor (XRS), magnetometer, Energetic Particle Sensor (EPS), and a High-Energy Proton and Alpha Detector (HEPAD) sensor.

The GOES N-Q satellites are the new series of satellites that will provide continuity of services that are presently being provided by the GOES I-M satellites. This series of spacecraft will improve on the current series through implementation of the following enhancements:

a) The use of Star Trackers will improve spacecraft pointing knowledge and stability.
b) A change in the WEFAX data transmission service from an analog to digital format.
c) Additional EMWIN network information
d) Elimination of the solar sail and boom will improve performance by allowing cooler detector temperatures.
e) The addition of Solar X-ray Instrument (SXI) on GOES-M and –N.

The GOES I-M spacecraft series is launched from the Cape Canaveral Air Station utilizing an Atlas Centaur Launch Vehicle. The GOES N-Q spacecraft will be launched from Launch Complex 17B at Cape Canaveral Air Station using a Delta III launch vehicle.

6.0 PROGRAM SCHEDULE COMMITMENTS

The GOES Program is not subjected to a rigid set of predetermined fixed launch dates, instead launches are determined by NOAA on an as-needed basis. NOAA is responsible for determining the need for satellite replacement through terms defined in the Launch Readiness and Planning Launch schedules. The current schedule is shown in Table 6-1. Launch Readiness and Planning Launch schedules are formally exchanged between NOAA and NASA semi-annually and form the basis for the formal budget (POP) process conducted by GSFC.

Table 6-1, GOES Program Schedule Requirements

Spacecraft	Launch Readiness Dates	Planned Launch Dates
GOES-I (8)	N/A	April 1994*
GOES-J (9)	N/A	May 1995*
GOES-K (10)	N/A	April 1997*
GOES-L	May 1999	May 1999
GOES-M (S/C)	Oct 2000	April 2002
GOES-M (L/V)	July 2001	April 2002
GOES-N	Oct 2002	Oct 2002
GOES-O	April 2004	April 2005
GOES-P (Option)	April 2006	April 2007
GOES-Q (Option)	April 2008	April 2010

*Launched
L/V: Launch Vehicle
S/C: Spacecraft

7.0 PROGRAM RESOURCES

Appendix A presents the latest GOES Program Operating Plan (POP). GSFC's ability to fulfill these commitments is contingent upon NOAA's ability to obtain funding through their budget process.

NASA develops funding requirements in response to NOAA's guidance. Funding requirements are reviewed by the Director of Flight Projects and the GSFC Center Director prior to submission to NOAA. The Program Commitment Agreement (PCA), Program Cost Commitment (PCC), and Program and Project plans are updated accordingly.

8.0 CONTROLS

Changes to baseline program documentation are in accordance with the Goddard Directives Management System (GDMS). Additionally, plans and agreements cannot be arbitrarily changed without a formal review and signature cycle.

9.0 RELATIONSHIPS TO OTHER PROGRAMS AND AGREEMENTS

The customer for the GOES Program is NOAA. Within NOAA, responsibility for the program has been delegated to the Systems Acquisition Office (SAO). The specific organizations within NOAA that share an interest in the GOES Program are indicated below:

a) Systems Acquisition Office (SAO)
b) National Environmental Satellite, Data and Information Service (NESDIS):
   - Office of Satellite Operations (OSO)
   - Office of System Development (OSD)
   - Office of Research and Applications (ORA)
   - Office of Satellite Data Processing and Distribution (OSDPD)
c) National Weather Service (NWS)
d) Space Environmental Center (SEC)

The NASA management responsibilities and procedures for the GOES Program are in accordance with NASA policy and guidance. The division of responsibilities between NASA and NOAA will be in accordance with the NOAA-NASA Basic Agreement of 1998 and the Memorandum of Agreement (MOA), dated April 1998.

Additionally, Kennedy Space Center (KSC) is responsible for providing insight into the contractor provided launch services as described in the Memorandum of Understanding between KSC and NASA, dated January 1999.

For GOES N-Q a formal agreement between Marshall Space Flight Center (MSFC) and GSFC was developed for testing of the Solar X-ray Imager (SXI) instrument.

10.0 ACQUISITION STRATEGY

In October 1985, a cost plus award fee contract was awarded to Space Systems Loral (SS/L) for the design and development of GOES I-M spacecraft. ITT (Fort Wayne, IN) was chosen as the subcontractor for development of the Imager and Sounder instruments.

In January 1998, a firm fixed price contract was awarded to Hughes Space and Communications Company (HSC) for the design, manufacture, integration and launch of two GOES satellites (-N and -O) with fixed price options for GOES-P and –Q. The GOES N-Q instruments were procured directly by GSFC and provided to HSC for integration into the spacecraft. GSFC awarded, on a non-competitive basis, the Imager and Sounder contract to ITT. The SXI (for GOES N-Q) is being competitively procured from Lockheed Martin Advanced Technology Center (LMATC).

11.0 COMMERCIALIZATION OPPORTUNITIES

There are no known commercial applications or products associated with the GOES program.

12.0 TECHNOLOGY ASSESSMENT

The Imager and Sounder instruments were state of the art at the time of their initial development. Advances were needed in detector technology and instrument pointing accuracy. These problems were resolved in early 1990's. No additional technology advancements are needed to complete the GOES Program.

13.0 DATA MANAGEMENT

NOAA and GSFC disseminate all GOES data.

14.0 RISK MANAGEMENT

The primary risk in meeting the GOES objectives relates to the continuity of a two-satellite constellation. A launch

failure or premature failure of the spacecraft or Imager and Sounder instruments could leave NOAA with inadequate spatial coverage needed to meet their requirements. Several strategies have been implemented to mitigate this risk.

a) Early build and scheduling of follow-on spacecraft.
   To mitigate the risk of continuous coverage by a two satellite system, all spacecraft are built and manifested to a schedule two years earlier than needed. This assures that hardware (satellites and launch vehicles) is always in the manufacturing process in the event of a premature failure.
b) On-orbit spares.

The GOES system includes one on-orbit spare. This will ensure resumption of a two-satellite system within days of a failure on-orbit.

c) Contractually required replacement missions on GOES N-Q. In the event of a failure of any GOES N-Q satellite within the first year of service, the Government can require a replacement satellite within three years. This requirement does not include, and is limited by, the need to provide Government Furnished Equipment (GFE) and Imager and Sounder instruments for the replacement mission. Nevertheless, the Program's strategy of maintaining continuous manufacturing will allow a timely recovery from a failure by using the next series of payloads. Additionally, should the need arise for out-of-series payloads, ITT will support the procurement of an additional set of instruments.

15.0 LOGISTICS

The customer, NOAA, provides the guidance for planning and provisioning of logistics.

16.0 TEST AND VERIFICATION

The procedures and guidelines for Post-Launch Testing (PLT) and the hand-over process are contained in 415-PG-5330.1.1, Post-Launch Checkout and Verification. This procedure establishes the process and responsibilities for PLT definition, spacecraft verification and final hand-over.

17.0 REVIEWS

An External Independent Readiness Review (EIRR) is held at the spacecraft contractor's facility prior to the launch of each satellite. The EIRR is comprised of an external independent panel of experts that review the launch readiness of the satellite and launch vehicle. A detailed description of the EIRR process and related deliverables is described in each spacecraft contract.

In addition to an EIRR, the program is reviewed annually by an independent team appointed by NASA HQ. The primary purpose of the Independent Annual Review (IAR) is to assess progress toward meeting the commitments contained in the PCA. This independent team reports findings to the NASA Program Management Council (PMA).

The Design Review Program (DRP) for each satellite is summarized below. Each review is described in detail in each spacecraft Contract Data Requirements List (CDRL), Mission Surveillance Plan, Program Review Requirements (PRR) document and each corresponding Project Plan.

- System Concept Review (SCR)
- Preliminary Design Review (PDR)
- Critical Design Review (CDR)
- Mission Operations Review (MOR)
- Pre-Environmental Review (PER)
- Pre-Shipment Review (PSR)
- Flight Operations Review (FOR)
- Launch Readiness Review (LRR)

The Launch Vehicle program review requirements are summarized below and are described in each spacecraft CDRL, PRR and corresponding Project Plan.

- Mission Integration Program Kickoff Review
- Requirements Review
- Component/System Design Review
- Mission Peculiar/Mission Unique PDR
- Mission Peculiar/Mission Unique CDR
- Pre-Installation Review
- Final Loads Verification Review
- Pre-Shipment Review
- Senior NASA Management Mission Readiness Review
- Pre-Payload Mate Review

- Launch Readiness Review

The Imager and Sounder instruments are subject to a Flight Assurance Review that consists of a PSR for each flight instrument.

In addition to periodic reviews, each spacecraft and instrument contractor conducts Project Status reviews. The detailed requirements for the review are contained in each spacecraft and instrument CDRL. These reviews are held bi-monthly, or as required by the GSFC Contracting Officer’s Technical Representative (COTR).

In accordance with S-415-12, the Solar X-ray Imager (SXI) instrument review requirements are as follows:

- System Requirements Review (SRR)

- Preliminary Design Review (PDR)
- Critical Design Review (CDR)
- Pre-Environmental Review (PER)
- Pre-Shipment Review (PSR)

18.0 TAILORING

NOAA controls program objectives, requirements, schedule and funding for the GOES Program. NOAA provides formal direction to NASA at least twice per year on a special schedule to accommodate the NOAA/DOC budget schedule. Schedules and funding remain somewhat flexible to respond to the on-orbit performance needs of the operational satellite program. The schedule and cost commitments contained in the PCA, PCC, Program and Project Plans will be updated after each budget cycle. This will ensure that the latest NOAA requirements are reflected in these documents and that NASA management, at all levels, is working to meet our customer's needs.

Schedule and cost commitment changes will be recorded in the activity logs of each of the documents and shall not require notification of the approving official. The Lead Center Director's signature on the formal transmittal letter to NOAA shall constitute authority to update these documents with the new cost and schedule commitments. Any changes other than those directed by NOAA shall require the signature of the appropriate approving official.

Appendix A: Program Operating Plan (POP)

Due to the sensitivity of POP data, packages are available from the GOES Program Office.